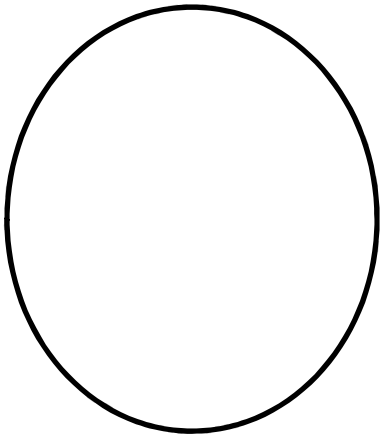
Name _____

Meiosis Simulation

A. Assembly of Original Chromosomes

You will work with your half of the row to simulate the stages of meiosis to make four haploid cells from one diploid cell. One group in your row will be making haploid cells for eggs and the other group in your row will make the sperm cells. Each group will build two homologous pairs of chromosomes, a long pair and a short pair.

1. Using 10 blue OR 10 green pop beads, assemble your first chromosome by attaching 7 beads together, then the centromere, then the remaining 3 beads
2. Using 10 red OR 10 yellow pop beads, assemble its homolog by attaching 7 beads together, then the centromere, then the remaining 3 beads
3. Using 5 blue OR 5 green pop beads, assemble the shorter homologous pair of chromosomes by attaching 3 beads together, then the centromere, then the remaining 2 beads
4. Using 5 red OR 5 yellow pop beads, assemble the other member of the pair by attaching 3 beads together, then the centromere, then the remaining 2 beads
5. Draw your original chromosomes in the circle to the right



B. Interphase I: DNA Duplication

6. Simulate DNA replication by piling your chromosomes in the nucleus of the Interphase I cell
7. Place 2 centrioles in the space indicated on your diagram
8. Next, duplicate your chromosomes by assembling 4 more identical chromosomes by repeating steps 1-4 above
    - Note: Although there is actually only one centromere between two identical sister chromatids, you will need to use one magnetic centromere for each chromatid in this simulation
9. Draw a diagram in the space to the right to show what your simulated cell looks like before meiosis begins

C. Meiosis I: Prophase I

10. To simulate this phase, start by moving the centrioles away from each other as indicated on the Prophase I diagram
11. Next move each homologous chromosome so that it pairs with its partner
    - You should have one tetrad of long chromosomes and one of short chromosomes
12. Simulate crossing-over by removing and exchanging identical segments of any two non-sister chromatids in a tetrad
    - The crossover site is called a "chiasma"
13. Draw a diagram in the space to the right to show what your simulated cell looks like at the end of Prophase I

D. Meiosis I: Metaphase I

14. Move the centrioles to opposite ends, or poles, of the Metaphase I cell
15. Align the tetrads at the equator so that the centromeres of homologous pairs face toward opposite poles
16. Draw a diagram in the space to the right to show what your simulated cell looks like at the end of Metaphase I

E. Meiosis I: Anaphase I

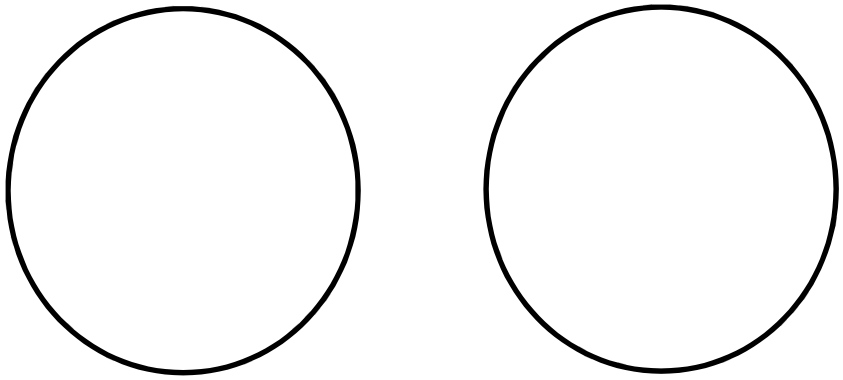
17. Using the Anaphase I cell diagram, separate the homologous pairs by moving one homolog toward each pole
    - Sister chromatids should still be connected through the centromeres
18. Draw a diagram in the space to the right to show what your simulated cell looks like at the end of Anaphase I

F. Meiosis I: Telophase I

19. Place your simulated chromosomes at the poles of your Telophase I cell diagram
    - You should have one long and one short chromosome at each pole, representing a homolog from each pair
20. Place your centrioles in the space provided
21. Draw a diagram in the space to the right to show what your simulated cell looks like at the end of Telophase I

G. <u>End of Meiosis I: Resulting in 2 Daughter Cells</u>

22. Draw a diagram in the space below to show what your simulated cells look like at the end of Meiosis I



Questions

1. How many daughter cells are produced at the end of Meiosis I?

2. Are the daughter cells identical to the original cell?

3. Are the daughter cells identical to each other?

4. Are the daughter cells diploid or haploid? Explain.

H. Interphase II

23. Move the chromosomes formed at the end of Meiosis I to the nuclei of the two cells on the Interphase II worksheet
24. Duplicate the centrioles and place them on the spots indicated
25. Draw a diagram in the space to the right to show what your simulated cells look like before Meiosis II begins

I. Meiosis II: Prophase II

26. Separate the centrioles to set up the axes of the two new spindles as indicated on the Prophase II diagram
27. Next place the chromosomes in the center of each cell
28. Draw a diagram in the space to the right to show what your simulated cells look like at the end of Prophase II

J. Meiosis II: Metaphase II

29. Move the centrioles to opposite ends, or poles, of the Metaphase II cells
30. Arrange the chromosomes with the centromeres lined up along the equator so that one chromatid is facing one pole while its sister chromatid faces the opposite pole
31. Draw a diagram in the space to the right to show what your simulated cells look like at the end of Metaphase II

K. Meiosis II: Anaphase II

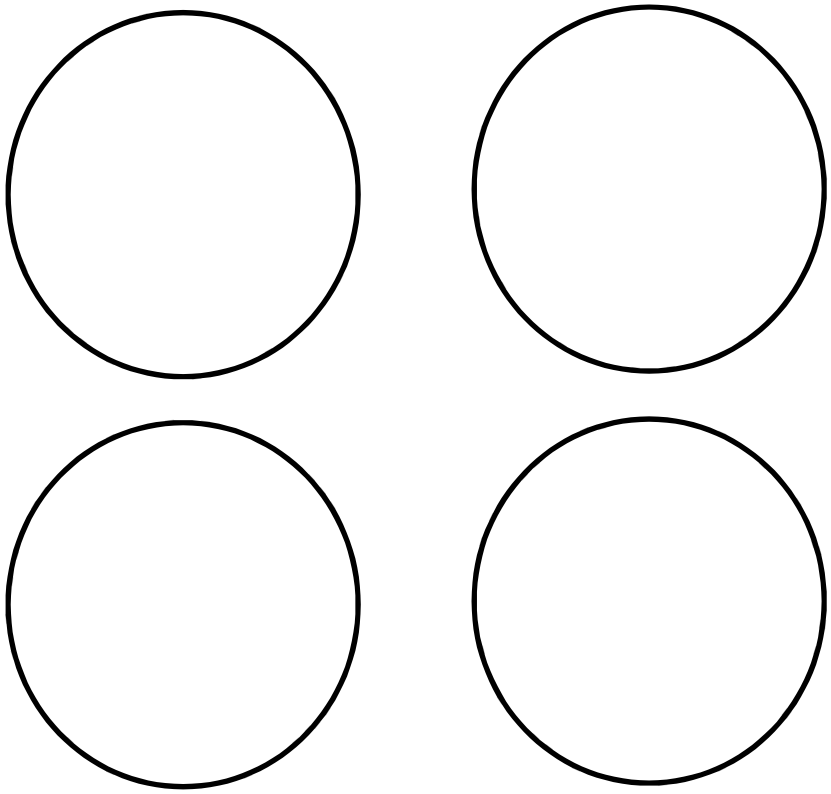
32. Using the Anaphase II cells diagram, separate the sister chromatids and move them to opposite poles
33. Draw a diagram in the space to the right to show what your simulated cells look like at the end of Anaphase II

L. Meiosis II: Telophase II

34. Place your simulated chromosomes at the poles of your Telophase II cells diagram
35. Place your centrioles in the space provided (they will be duplicated once cell division is complete)
36. Draw a diagram in the space to the right to show what your simulated cells look like at the end of Telophase II

M. End of Meiosis II: Resulting in 4 Daughter Cells

37. Draw a diagram in the space below that shows what your simulated cells look like at the end of Meiosis II



Questions

5. How many daughter cells are produced at the end of Meiosis II?

6. Are the daughter cells diploid or haploid? Explain.

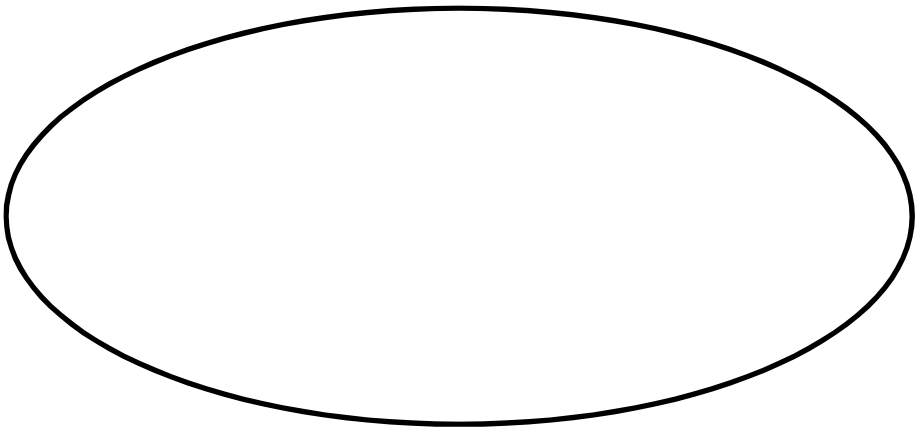
7. How are the daughter cells similar to each other?

8. How are the daughter cells different from each other?

N. Fertilization

Join the other group in your row to model fertilization. Each group should now have four haploid cells. That is, each will have four cells with one set of chromosomes each.

38. Choose one cell from one group to represent the egg and one cell from the other group to represent the sperm
39. To simulate the pooling of chromosomes after the fusion of the two cells, place the chromosomes from the egg and the sperm in the "Fertilized Egg" cell diagram
40. Draw a diagram in the space below to show what your simulated cell nucleus looks like after fertilization
    - Use colored pencils to color the two pairs of homologous chromosomes



Questions

9. After fertilization, is the cell diploid or haploid? Explain.

10. If the chromosome number was not reduced during meiosis, what would happen during fertilization?

11. Describe at least 2 different ways genes are rearranged during meiosis.